

January 31, 1916), gives the results of experiments on the effects of low temperatures upon the trichinous larvæ. In the practical application of refrigeration as a means of destroying the vitality of trichinæ, meat should be refrigerated at a temperature not higher than 5° F. for not less than twenty days, a period which allows a probable margin of safety of nearly ten days. The employment of higher temperatures of refrigeration as a means of destroying the vitality of trichinæ is not justified in the light of our present knowledge because of the uncertainty of the effects of such temperatures. Whether temperatures higher than 5° F. may be safely employed by lengthening the period of refrigeration remains to be determined. It is at once evident that refrigeration is a better safeguard than microscopic examination. The combination of refrigeration and thorough cooking would protect man against trichinosis.

**The Prophylaxis of Tetanus.**—A valuable summary of the literature on the prophylaxis of tetanus has been written by A. T. MACCONKEY (*Brit. Med. Jour.*, December 11, 1915). Regarding the value of prophylactic injections of antitetanic serum, the author says that the experience of the British Army has shown that the proceeding has a well-established value, for in the last six months there have been only 36 cases of the disease among those who received a preventive dose of serum within twenty-four hours after being wounded. The accompanying table shows the results which other investigators have obtained:

Investigator.	No. of wounded.	Cases of tetanus.	No. injected.	Cases among them.
Bazy . .	10,896	129	100	1
Hartmann . .	3,373	43	Number not given	No cases reported.
Gasch . .	700	1	70	0
Hufnagel . .	2,193	27	1,195	0
Goldscheider . .	1,427	4	500	4 <sup>1</sup>
Madelung . .	15,134	101	Number not given	No cases reported.
Heile . . . .	...	...	4	0

The author's conclusions that although too great reliance should not be placed upon the figures quoted, yet from this experimental evidence it may be gathered that the army medical officers have found tetanus antitoxin of great value when used prophylactically, thus confirming by the severe test of active service the value as estimated before the war. The author next discusses the number of U. S. A. units of antitoxin which should be given as a prophylactic dose. In considering this matter, it becomes necessary to specify the kind of unit referred to as 1 German unit—40 U. S. A. units, while various investigators—Behring, Rosenau and Anderson and MacConkey have found the number of U. S. A. units in samples of French serum to vary, the general conclusion being, however, that the usual prophylactic dose of 10 c.c. of Pasteur Institute serum equals some 600 U. S. A. units. The doses recommended by fifteen different writers are cited, and the conclusion is drawn that from 500 to 1000 U. S. A. units of tetanus antitoxin is a sufficiently large prophylactic dose for the great majority of injuries, provided it is given early. Some cases are described, however, in which

<sup>1</sup> Such cases should probably not be included, as there were other complications.

the injection of from 1500 to 4000 U. S. A. units seems to have had only a comparatively limited effect, if any, in preventing the onset of an attack. In some, the interval between the injection and the onset of the disease was too short to allow of the development of the full effect of the antitoxin. "The most remarkable of these," says the author, "is that recorded by von Behring, in which one of his assistants, who had twice before been injected with tetanus, was the third time infected by a flask of tetanus bouillon breaking in his hand and pieces of glass penetrating deep into his palm. Careful antiseptic treatment was immediately given and a plentiful amount of antitoxin injected. On the fifth day there was obvious tetanus which, in spite of further injections of serum, increased in severity, so that on the seventh day the chief nerve trunks in the right axilla were exposed and as much as possible of von Behring's strongest solution was injected, with the result that the case slowly recovered." As to the duration of the passive immunity conferred by a dose of antitoxin, the author says this is a question which has been investigated, but is still unsettled. He cites an experiment by Meyer and Ransom which showed that the passive immunity conferred on the leg of a dog by an amount of antitoxin sufficient to neutralize all the toxin injected began to pass off in a week. The experiments of Ruediger are quoted as showing that the subcutaneous injection of 1500 U. S. A. units of antitetanic horse serum into a horse confers a passive immunity lasting from six to eight weeks and that 250 U. S. A. units of similar tetanus antitoxin will protect guinea-pigs for four weeks, *vs.* a dose of toxin fatal to the control animals. Calculating from these figures, MacConkey found that according to body weight only a man weighing 70 kilos would require 3500 U. S. A. units of antitoxin to protect him for a month against a fatal dose of tetanus toxin. Leven, in his work, states if 10, 20, or 40 c.c. of heterologous serum be injected into a rabbit practically all has disappeared at the end of about six days, and that if it is wished to keep the antibody concentration at a certain height for some time, it is better to give a series of relatively small doses and not one very large one. The conflicting results of several cases, in one of which 12,000 units protected for only thirteen days, while in another 1500 units conferred immunity for over three weeks, and the experience of the British Army that small dose—500 U. S. A. units—is many times effective, lead the author to agree with Leven in his conclusion that if necessary to give a large amount of antitoxin it is better to give a series of small doses rather than one large one. Other cases which are puzzling are those in which tetanus develops late, and these are next discussed by the writer. He mentions various causes found by investigators to be responsible for late development of tetanus infection in hospitals from one patient to another, infection from felt which was used in two cases as a packing for a plaster corset, infection from an East Indian fiber used for dressing wounds, activation of tetanus spores which had been introduced in vaccine viruses by the late injection of *Staphylococcus* or quinin. The author also cites the work of several other workers who report cases of tetanus following some slight operation or trauma affecting a wounded soldier who had been treated with a prophylactic dose of serum and had apparently long recovered from his wound. A case was described in which the infection was pos-

sibly due to too early and prolonged activity after the healing of the wound. Regarding operating in cases of tetanus, the author says the experiences during the war have not changed opinion in respect to that, since it has been shown by Bolton and Fisch (1902) that toxin makes its appearance in the blood of a horse several days before the symptoms of the disease appear, and that it increases until about two days before the symptoms are noticed, when it suddenly diminishes. The author reports a number of cases which confirm these facts and show that operating is ordinarily of no effect because the toxin is already present in the blood. When an operation is proposed in wounded who have been infected with tetanus, MacConkey emphasizes the fact that it is imperative to keep in mind that there may be toxin circulating in the body and therefore that a large prophylactic injection is necessary which should be given in such a way as to ensure that there is no free toxin in the blood at the time of the operation and for some time after. The injection must be given either intramuscularly, in which case the operation should not take place for some hours, or intravenously. In the latter case the operation can be performed immediately, but it involves the possibility of anaphylactic trouble. The conclusions which the author draws are: (1) That from 500 to 1000 U. S. A. units of tetanus antitoxin is a sufficient prophylactic dose for the majority of cases, but that it is advisable in severe wounds to repeat the dose once or twice at intervals of a week. (2) The occasional cases in which antitoxin appears to have little preventive effect should be recorded in minute details. (3) Those cases of tetanus which develop some weeks after the receipt of an injury may be due to the reactivation of a quiescent focus by too early or too energetic active or passive movement.

---

**Industrial Poisoning with Analin.**—LUCE and HAMILTON (*Jour. Am. Med. Assn.*, May 6, 1916, lxvi, 1441) point out that industrial poisoning from analin and substances closely allied to it is well known in Germany and in Great Britain. It is just beginning to be known in the United States, where it has already been the cause of many cases of poisoning among men engaged in the manufacture of rubber goods, in reclaiming rubber from scrap, in making analin from benzene, and in using certain washes for press rollers. It also occurs in the dye industry. Analin causes the formation of methemoglobin and poisoning may take place through the skin or the lungs. Exposure to the fumes need not be excessive nor long continued to bring about serious symptoms in the susceptible. Young men are more susceptible than the old or middle-aged, blonds than dark-haired men, heavy drinkers than the temperate. Hot, humid weather, heated rooms, and poor ventilation are important factors in the production of acute analin poisoning. Early recognition of analin poisoning is of prime importance, so that the sufferer may be withdrawn from the danger of further exposure. Men working constantly in analin seem to acquire a certain amount of tolerance to it, but chronic poisoning may result apparently from cumulative effect. After symptoms of poisoning have once manifested themselves, the individual is usually hypersensitive to the fumes.